

**Two New Soleid Flatfishes**  
**(Pleuronectiformes: Soleidae: *Soleichthys*)**  
**from Australian Waters, With a Re-description of**  
***Soleichthys microcephalus* (Günther)**

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**ABSTRACT.** *Soleichthys microcephalus* (Günther, 1862) occurring in warm temperate waters off New South Wales, Australia, is re-described based on examination of a syntype and additional non-type material. This species differs from congeners in its combination of: low meristic features (43–45 vertebrae, 71–84 dorsal-fin rays, 61–71 anal-fin rays, and 81–89 lateral-line scales); in having two elongated ocular-side pectoral-fin rays of nearly equal length; with small scales present on the ocular-side pectoral-fin base and proximal halves of elongated pectoral-fin rays; in its ocular-side pigmentation consisting of a series of 8–10 mostly complete, bold, wide, dark-brown or blackish crossbands of nearly uniform width throughout their lengths and noticeably wider than the alternating lighter-coloured crossbands; and with two, conspicuous, mid-lateral white spots arranged in horizontal series. Two new species phenotypically most similar to, and with meristic features that largely overlap those of *S. microcephalus*, are described from specimens collected in tropical waters of northern Australia. *Soleichthys serpenpellis* n.sp., known from the Gulf of Carpentaria and Delambre Island, Dampier Archipelago, northwestern Australia, is easily distinguished from *S. microcephalus* and other congeners by its ocular-side head and body pigmentation featuring incomplete, diamond-shaped crossbands broadest in their mid-sections, fewer (about 6) ocular-side body crossbands, and with small, brown spots scattered in the interspaces between the crossbands. *Soleichthys oculofasciatus* n.sp. occurs off northeast Australia and is distinguished from congeners in its combination of a first elongate ocular-side pectoral-fin ray longer than the second, in lacking scales on the ocular-side pectoral-fin base and elongate pectoral-fin rays, in having a longitudinal series of crossbands (usually 11) on the ocular-side head and body, and with four conspicuous white spots on the body, two of which are arranged in a vertical series at mid-body. The new species differs further from both *S. microcephalus* and *S. serpenpellis* in having a longer and narrower head and a longer caudal fin.

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## Introduction

Species of the soleid genus *Soleichthys* Bleeker, 1860 are poorly known. Nine nominal species of soles are now placed in *Soleichthys* (*Solea heterorhinos* Bleeker, 1856, *Aesopia multifasciata* Kaup, 1858, *Solea microcephala* Günther, 1862, *Solea tubifera* Peters 1876, *Solea borbonica* Regan, 1905, *Solea nigrostriolata* Steindachner & Kner, 1870, *Solea lineata* Ramsay, 1883, *Soleichthys siammakuti* Wongratana, 1975, and *Soleichthys maculosus* Muchhala & Munroe, 2004), and several other undescribed species are known (Munroe, unpubl. data). Most of the nine nominal species placed in *Soleichthys* were described and remain known only from the holotype or relatively few specimens. Most nominal species of *Soleichthys* are small flatfishes seldom exceeding 180 mm in SL, and most are collected only infrequently using trawls. Some species are observed and photographed by SCUBA divers in coral reef habitats (e.g., Kuitert, 1993), and are often seen during night-time dives when fish are actively moving.

Externally, members of *Soleichthys* have an elongate, tubular, ocular-side anterior nostril; a well-developed ocular-side pectoral fin; no elongate dorsal-fin rays; and they have dorsal and anal fins separate from the caudal fin except for a thin, delicate membrane at the base of the caudal fin. Unlike many other soleids that have uniformly drab ocular-side pigmentation, most species of *Soleichthys* have conspicuous ocular-side pigmentation patterns featuring either boldly pigmented crossbands or other conspicuous markings such as blotches and spots, or with some combination of these markings.

There has not been consistent acceptance or application of generic names for nominal species currently recognized in *Soleichthys*. Bleeker (1860) erected the new genus, *Soleichthys*, to accommodate *Solea heterorhinos* Bleeker, 1856. Kaup (1858) had earlier created a new genus, *Aesopia*, that consisted of five species including *A. multifasciata*, which shares many similarities with *Solea heterorhinos*. Based on Kaup's inclusion of *multifasciata* in *Aesopia*, Chabanaud (1930, 1934) considered *Aesopia* Kaup, 1858, to be the senior synonym of *Soleichthys*. However, of the five species originally composing this genus, Günther had earlier (1862) restricted *Aesopia* Kaup, 1858 to include only *A. cornuta* Kaup, 1858, a distinctive species featuring a greatly elongated first dorsal-fin ray, cycloid scales, and dorsal and anal fins broadly continuous with the caudal fin. Günther (1862) transferred the other four soleid species originally assigned to *Aesopia* Kaup, including *multifasciata*, to *Synaptura*. In the same work, Günther (1862) also described *Solea microcephala* based on two syntypes collected off Sydney Harbour, New South Wales. This species was characterized by several distinctive features including an elongate, tubular ocular-side anterior nostril, dorsal and anal fins terminating immediately before the caudal-fin base, ctenoid scales, and an ocular-side

pigmentation featuring a pattern of 11–13 dark brown crossbands. McCulloch (1917) recognized that the elongate, tubular, ocular-side anterior nostril, the separate dorsal, anal and caudal fins, ctenoid scales and the non-elongate first dorsal-fin ray (compared with that of *Aesopia cornuta*) were features shared by *Soleichthys heterorhinos*. Because *Solea microcephala* shared many features with those of *S. heterorhinos*, the type species of *Soleichthys* Bleeker, McCulloch (1917) recommended recognition of *Soleichthys* as the correct generic placement for these species. Subsequent authors (Norman, 1928; Quéro, 1997) have continued to recognize *Soleichthys* as distinct from *Aesopia*.

The number of species of *Soleichthys* considered valid, however, has varied according to different authors and more work is needed to determine the status of many of these nominal species. Most nominal species in the genus, except for *S. microcephalus* and *S. siammakuti*, have, at one time or another, been placed into the synonymy of *S. heterorhinos*. For example, *Solea nigrostriolata* was considered a junior synonym of *S. heterorhinos* by several authors (Günther, 1909; Norman, 1926, 1928; Weber & de Beaufort, 1929; McCulloch, 1929–1930; Chabanaud, 1934). *Solea lineata* has also been considered conspecific with *S. heterorhinos* (McCulloch, 1916, 1917; Norman, 1926, 1928; Weber & de Beaufort, 1929; Chabanaud, 1934), although in other papers (McCulloch, 1921, 1922, 1927), *S. lineata* was tentatively considered a valid species, or was even suggested to be a juvenile *Soleichthys microcephalus*.

Three nominal species of *Soleichthys* recorded from Australian waters are: *S. heterorhinos* from tropical waters off the inner northwestern continental shelf, *S. microcephalus* from off New South Wales, and *S. lineatus*, a species of questionable identity described from a single, small, damaged specimen taken off Port Jackson, New South Wales. A fourth species occurring in the general region is *S. nigrostriolatus*, which is known from specimens taken off Viti-Levu, Fiji Islands.

Of the nominal species of *Soleichthys* reported from or near Australian waters, only *S. heterorhinos* and *S. microcephalus* are presently considered valid by most authors. Although considerable confusion has been associated with other nominal species superficially resembling *S. heterorhinos*, specimens identified in collections as *S. microcephalus*, in contrast, have offered no such confusion, and the presence of more than one species among material identified as this species has not previously been proposed. During examination of soleid material collected from Australian waters and labelled in collections as *S. microcephalus*, we found fishes representing several morphotypes featuring ocular-side pigmentation patterns and other features different from those of *S. microcephalus*. Objectives of this paper are to re-describe *S. microcephalus* based on new material and new characters, and to formally describe those species presently being confused with, and mis-identified as, this species.

## Materials and methods

Counts made from radiographs include: epicranial pterygiophore complex, which is the formula representing the number of pterygiophores inserted onto the erisma, followed by the number inserted onto the posterodorsal cranium, with the third number representing the number of pterygiophores associated with the neural spine of the second abdominal vertebra (Chapleau, 1989; Desoutter & Chapleau, 1997). Counts of dorsal-, anal- and caudal-fin rays include all rays counted at their bases. Vertebral counts are reported as the total number of vertebrae. Counts made directly from the specimen include: lateral-line scales, starting dorsal to opercular angle and continuing posteriorly along lateral line to end of hypural plate, but excluding scales extending onto caudal-fin rays; right and left pectoral-fin rays and right and left pelvic-fin rays were also counted directly from the specimen. Measurements were made either on ocular- or blind-side surfaces. All measurements refer to standard length, unless otherwise noted. Measurements <150 mm were taken to the nearest 0.1 mm with dial calipers or an ocular micrometer; measurements >150 mm were taken to the nearest mm. Morphometric features, except standard length (in mm), are expressed either as thousandths of standard length (SL) or head length (HL) and are defined as follows: Standard length (SL): distance from tip of fleshy snout to posterior end of hypural plate. Trunk length (TKL): longitudinal distance from posterior angle of operculum to caudal-fin base. Body depth (BD): greatest distance across body exclusive of fins. Pre-dorsal length (PDL): tip of fleshy snout to base of first dorsal-fin ray. Caudal-fin length (CFL): base of articulations of middle caudal-fin rays to tip of longest (usually middle) rays. Pectoral-fin length (PL): basal articulation to distal tip of longest ray on ocular side. Head length (HL): tip of fleshy snout to most posterior extension of upper fleshy lobe of operculum. Head width (HW): greatest distance across head at anterior portion of operculum. Postorbital head length (POL): posterior margin of fixed (non-migrated) eye to posterior extent of upper fleshy lobe of operculum. Snout length (SNL): anterior rim of fixed eye to tip of snout. Upper jaw length (UJL): shortest horizontal distance from bony tip of premaxilla to angle of mouth. Eye diameter (ED): greatest horizontal diameter of cornea of fixed eye; does not include fleshy tissue surrounding eye.

Qualitative characters also observed for each specimen were: patterns of body and fin pigmentation, especially number, location and types of crossbands and spots; degree of pigmentation on opercles and isthmus regions; positions of posterior margin of lower jaw and anterior nostril relative to fixed eye; location and shape of lateral line; and relative position of the eyes.

Specimens examined are listed in each species account. Abbreviations for collections follow Eschmeyer (1998).

## Characters that apply to all three species

Small-sized, dextral flatfishes, featuring a small head and blunt snout without a hook. Blind-side head and snout with numerous cirri (hair-like tufts) anteriorly and along region at bases of anteriormost dorsal-fin rays, some species with cirri best developed posteriorly at gill opening. Ocular-side anterior nostril a prominent elongate tube situated just dorsal to mid-point of upper jaw. Ocular-side posterior nostril a short, wide, ventrally-directed or sometimes erect tube located between posterior base of anterior nostril and anterior margin of fixed eye. Blind-side anterior nostril a short, usually inconspicuous, dorsoposteriorly-directed, wide tube located just dorsal and just anterior to mid-point of lower jaw and surrounded and barely perceptible among dense dermal papillae and cirri on blind-side snout. Posterior blind-side nostril a short, wide, posteriorly-directed tube (ca. twice length of anterior blind-side nostril) located posterior to vertical at posterior margin of jaws, situated at posterior margin of raised area of dense cirri on blind-side snout and offset (slightly dorsal to horizontal through anterior nostril) from anterior blind-side nostril. Mouth small, terminal, with jaws slightly curved ventroposteriorly at their mid-point; mid-region of ocular-side lower jaw with obvious, fleshy, triangular dermal process. Both ocular- and blind-side upper lip connected to snout by frenum. Ocular-side jaws without teeth; blind-side jaws with small bands of villiform teeth best developed posteriorly and with tooth bands on lower jaw generally wider than those of upper jaw. Eyes dextral, contiguous, and slightly subequal (migrated eye slightly anterior to fixed eye); interorbital space narrow and slightly raised, with 2–5 rows of ctenoid scales between anterior margins of eyes, a continuous row of scales between eyes, and with 3–4 scales between posterior margins of eyes. Opercular opening complete, with gill covers connected to each other and free from isthmus. Ocular-side lateral line continuous and straight on body midline from point dorsal to anterior margin of opercle to distal one-third, or distal tip, of middle caudal-fin ray. Lateral line on blind side similar to that on ocular side except pored scales along body at basal region of dorsal fin with well-developed cirri. Dorsal fin extending nearly to base of caudal fin and with posteriormost dorsal-fin ray connected at its base to caudal fin by thin, delicate membrane. Anteriormost dorsal-fin rays unbranched; most others with two (usually) or three branches at their tips. Anal-fin origin just posterior to anus; posteriormost anal-fin ray connected at its base to caudal fin by thin, delicate membrane; some anal-fin rays branched (two or three branches) at their tips. All caudal-fin rays, except dorsalmost and ventralmost, branched. Pectoral fins asymmetrical, that on ocular side longer than its counterpart, connected by membrane to upper pectoral-fin rays. Base of ocular-side pectoral fin about equal to one-third to one-half length of longest pectoral-fin ray. Blind-side pectoral-fin rudimentary. Pelvic fins short and symmetrical, each with 5 unbranched rays; middle fin rays longer than others; pelvic fins separate from each other and from anal fin; posteriormost ocular-side pelvic-fin ray attached to urogenital papilla by thin membrane. Anus located on body midline and surrounded by pelvic fins. Urogenital papilla a short or elongate, bluntly-pointed tube located slightly off body midline on ocular side just posterior to anus.



***Soleichthys microcephalus* (Günther, 1862)**

Figs. 1, 2; Tables 1, 2

## Smallhead sole

*Solea microcephala* Günther, 1862: 466 (original description with counts, measurements; New South Wales, Australia); Kner, 1867: 288 (counts, measurements; off Sydney, New South Wales); Macleay, 1882: 135 (counts, measurements; Port Jackson, New South Wales); Ogilby, 1886: 49 (listed, common in Port Jackson; coastal waters of New South Wales); Waite, 1904: 44 (listed; New South Wales); Stead, 1908: 105 (brief description with figure, size estimate, common in estuaries on mud bottoms; New South Wales); Roughley, 1916: 176 (description, counts, measurements, figure; coast of New South Wales, Australia; common in estuaries).

*Soleichthys microcephalus*.—McCulloch, 1917: 90 (assigned to *Soleichthys*; New South Wales); McCulloch, 1921: 47 (in key, figure, partial synonymy, uncommon in estuaries; New South Wales); McCulloch, 1922: 37 (in key, figure, partial synonymy, uncommon in estuaries; New South Wales); Norman, 1926: 286–287 (synonymy, in key; New South Wales); McCulloch, 1927: 37 (in key, figure, partial synonymy, uncommon in estuaries; New South Wales); McCulloch, 1929–1930: 283 (listed; New South Wales); Wongratana, 1975: 27 (comparisons with *S. siammakuti*); Yearsley *et al.*, 1997 (listed in Appendix D).

*Aesopia microcephala*.—Chabanaud, 1930: 555 (assigned to *Aesopia*); Chabanaud, 1934: 427 [in key; counts, including vertebrae; considered *S. borbonica* (Regan) as a subspecies of *A. microcephala* (Günther)]; Kuitert, 1993: 389 (description; size to 22 cm; colour photographs, including juvenile; New South Wales in estuaries and inshore waters, at 3–20 m).

*Aesopia microcephalus*.—Munro, 1938: 70 (description, with counts, measurements, colour figure; New South Wales).

**Type material.** SYNTYPE, BMNH 1855.9.19.1247, 159 mm SL, Australia.

**Other material examined.** AMS I.26311-003, 151.1 mm SL, east of Urunga, 30°27'–32°S 153°8'E, 33–43 m; AMS I.37360-001, 145.1 mm SL, off Newcastle 32°51'S 151°55'E, 31–34 m; AMS I.37372-001, 4(151.3–169.4 mm SL), off Newcastle, 32°51'–52°S 151°53'E; AMS I.19117-003, 137.0 mm SL, Sydney Harbour 33°48'S 151°14'E;

USNM 59956, 140.2 mm SL, off Port Jackson 33°51'S 151°16'E; USNM 47886, 2(122.8–159.7 mm SL), off Port Jackson 33°51'S 151°16'E; AMS I.1103, 171.7 mm SL, off Port Jackson 33°51'S 151°16'E; QM I.1189, 171.0 mm SL, off Port Jackson 33°51'S 151°16'E; QM 1191, 165.1 mm SL, off Port Jackson, 33°51'S 151°16'E; QM 1192, 113.4 mm SL, off Port Jackson 33°51'S 151°16'E.

**Distinguishing characters.** *Soleichthys microcephalus* is readily distinguished from congeners by its combination of: low meristic features (43–45 vertebrae, 71–84 dorsal-fin rays, 61–71 anal-fin rays, and 81–89 lateral-line scales), its ocular-side pigmentation pattern consisting of a series of 8–10 dark-brown to black, mostly complete crossbands on the body, with body crossbands noticeably wider than the alternating lighter-coloured crossbands, with three dark-brown crossbands continuous across head, two conspicuous white spots in longitudinal series on the ocular-side midline, in having two elongated ocular-side pectoral-fin rays of nearly equal length or with the second fin ray longer than first, and in having small scales present on bases and proximal halves of elongated ocular-side pectoral-fin rays.

**Description.** Meristic and morphometric features for a syntype and 14 non-type specimens are summarized in Tables 1 and 2. Body oblong, greatest depth at point between gill opening and just anterior to body mid-point, body depth nearly uniform throughout most of length with rapid taper only in posterior one-fifth of body; body thick, especially in region of pectoral fins. Head ca. 0.41–0.45 BD; wider than long (HW ca. 1.3–1.5 HL), with dorsal and ventral contours smoothly arching posteriorly. Snout slightly squarish in anterior profile; about equal to or just slightly longer than ED; snout tip slightly anterior to horizontal through dorsal margin of fixed eye. Ocular-side anterior nostril usually extending to mid-point of fixed eye when depressed posteriorly. Posterior margin of jaws usually reaching to vertical through anterior margin of pupil of fixed eye. Ocular-side lips generally smooth; blind-side lips with obvious plicae. Gill covers fringed with conspicuous cirri, especially that on blind side; ocular-side opercle connected

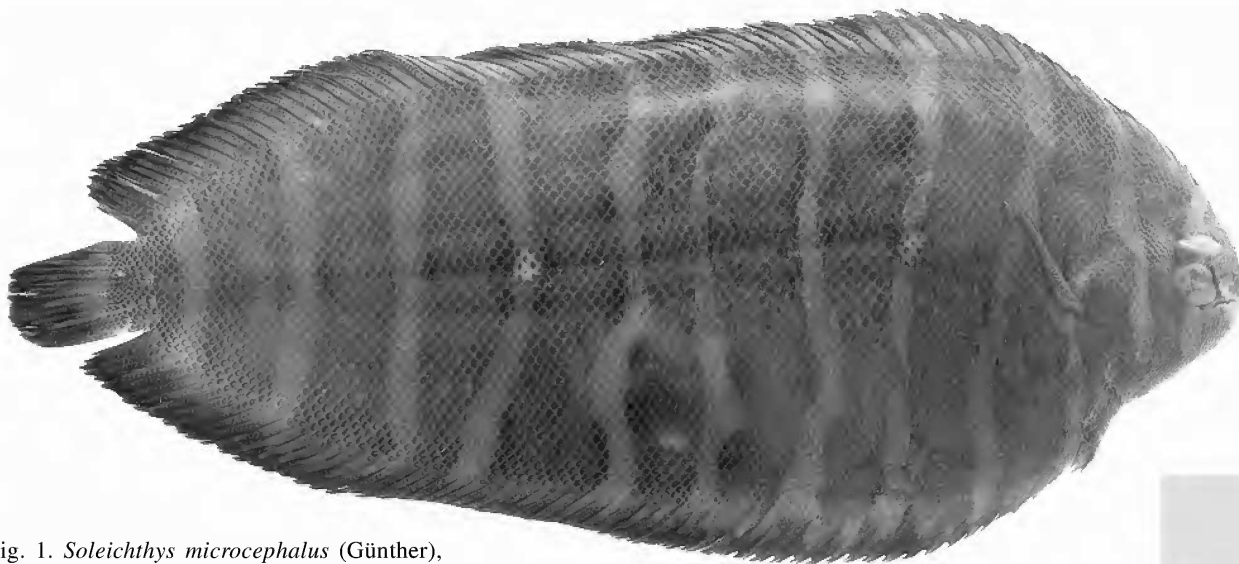


Fig. 1. *Soleichthys microcephalus* (Günther), AMS I.19117-003, 137.0 mm SL, Sydney Harbour, Australia, 33°48'S 151°14'E.



**Table 1.** Selected meristic features for three Australian species of *Soleichthys*. Asterisk \* indicates value for holotype or syntype.

species	total vertebrae				mean
	43	44	45	46	
<i>S. serpenpellis</i>	–	1	4*	–	44.8
<i>S. oculo fasciatus</i>	–	–	1	1*	45.5
<i>S. microcephalus</i>	3	7	4	–	44.1

species	dorsal-fin rays														mean
	71	72	73	74	75	76	77	78	79	80	81	82	83	84	
<i>S. serpenpellis</i>	–	–	–	–	–	1	–	1	1*	–	–	–	–	2	80.2
<i>S. oculo fasciatus</i>	–	–	–	–	–	–	–	–	1	–	1*	–	–	–	80.0
<i>S. microcephalus</i>	1	–	–	2	3	1*	3	1	3	–	–	–	–	1	76.7

species	anal-fin rays														mean
	58	59	60	61	62	63	64	65	66	67	68	69	70	71	
<i>S. serpenpellis</i>	–	–	–	–	–	–	1*	–	–	1	1	–	–	2	68.2
<i>S. oculo fasciatus</i>	–	–	–	–	–	–	–	–	–	–	2*	–	–	–	68.0
<i>S. microcephalus</i>	–	–	–	2	–	3	1	1	4*	–	–	3	–	1	65.5

species	lateral line scales														mean
	81	82	83	84	85	86	87	88	89	90	91	92	93	94	
<i>S. serpenpellis</i>	–	–	1	–	–	–	1	–	–	2*	–	–	–	–	89.0
<i>S. oculo fasciatus</i>	–	–	–	–	1*	1	–	–	–	–	–	–	–	–	85.5
<i>S. microcephalus</i>	1	1	2	1	3	4	–	1*	2	–	–	–	–	–	85.2

by thin membrane to dorsalmost pectoral-fin rays (usually rays 1–3 or 1–4) from their bases to mid-points. Blind-side opercle broadly connected by thick membrane to entire lengths of first three or four blind-side pectoral-fin rays. Ocular-side lateral line arching anteriorly over operculum and continuing onto head to about region dorsal to anterior margin of migrated eye. Dorsal-fin origin on midline of head usually at vertical equal to point between mid-point and anterior margin of migrated eye, or just slightly anterior to anterior margin of eye. Anterior dorsal-fin rays shorter than others. Dorsal-fin pterygiophore formula 1-0-2 or 1-1-2. Ocular and blind sides of dorsal- and anal-fin rays noticeably scaly; anterior dorsal- and anal-fin rays with small ctenoid scales basally (anterior rays of blind-side dorsal and anal fins usually without scales); at approximately body mid-point, both sides of dorsal and anal fins with series of ctenoid scales covering proximal one-third to one-half of fin rays; in posterior one-third of body, scales on dorsal- and anal-fin rays gradually increasing in number and eventually covering nearly entire lengths of fin rays or at least proximal two-thirds of their lengths. Caudal fin relatively large with distal margin nearly square; with 16–18 caudal-fin rays. Both sides of caudal fin scaly nearly to distal tips of fin rays. Ocular-side pectoral fin long, pointed, with 8–11 rays, the two dorsalmost rays elongate with remainder progressively decreasing in size. Ocular-side elongate pectoral-fin rays nearly equal in length, or with second ray slightly longer than first; elongated pectoral-fin rays covered with strong ctenoid scales on proximal one-third of their lengths; remainder of fin scaly on basal region. Blind-side pectoral fin squarish, with 7–11 short rays, those in dorsal third of fin longer than others; blind-side pectoral fin with a few small scales along bases of fin rays and with

noticeably scaly fin base. Base of ocular-side pelvic fin slightly anterior to that of blind-side fin. Scales on body relatively small and rounded, slightly wider than long and strongly ctenoid. Ctenii on blind-side body scales not as strongly developed as those on ocular-side scales. Lateral-line scales smaller than surrounding scales, cycloid, diamond-shaped, and with small, slightly elevated pore.

**Pigmentation** (based on live specimen from Kuitert, 1993). General background colouration of ocular side light brown with a series of prominent, dark-brown to black crossbands alternating with lighter-brown crossbands. Ocular side of head with three black and one white crossbands continuous across head and with one incomplete black band from dorsal margin to about midpoint of head (about equal with horizontal through migrated eye); anteriormost black crossband located on snout and chin; second black crossband located immediately posterior to eyes; third black band crossing head at distal margin of opercle. White band crossing head at posterior region of eyes. Upper surfaces of eyes white. Anterior ocular-side nostril conspicuously dark-brown to black. Body usually with nine, black, relatively straight, crossbands of nearly uniform width and bands usually continuous across body from base of dorsal fin to base of anal fin. Total number of black crossbands (head and body combined) 13. Crossbands on body broader, sometimes as much as twice as wide, than proximate lighter-coloured crossbands. Dark crossbands sometimes extending onto dorsal and anal fins. No conspicuous, rounded, white spots in longitudinal series on midline of ocular side of body. Ocular sides of dorsal, anal and caudal fins brilliantly pigmented with alternating series of mostly similarly-sized bright blue and black blotches throughout entire lengths of fins.

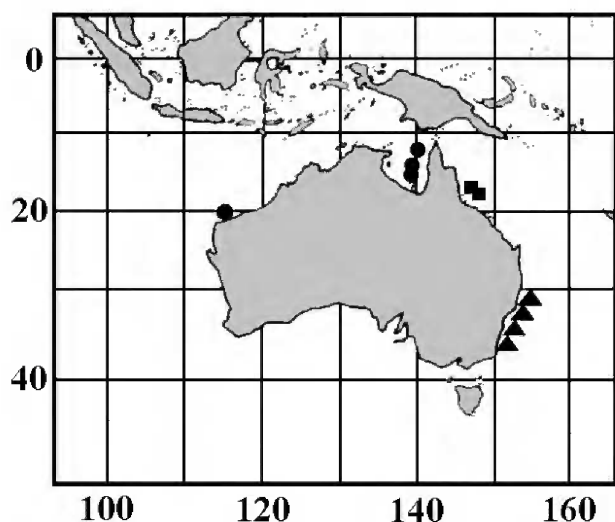


Fig. 2. Capture locations for three Australian species of *Soleichthys*. ▲ = *S. microcephalus*; ● = *S. serpenpellis*; ■ = *S. oculofoasciatus*.

Life colours of a juvenile specimen (Kuiter, 1993), photographed in July at about 5 m in Camp Cove, Sydney Harbour (Kuiter, pers. comm.), strikingly different than that of adult. Ocular surface background coloration uniformly off-white with an irregular series of rounded or oblong darker blotches posterior to pectoral fin. Anterior snout, upper lip, and especially anterior ocular-side elongate nostril, dark black. Mouth and ventral margin of head silhouetted in orange. Basal halves or slightly more of dorsal, anal and caudal fins with similar coloration as that of body; two continuous longitudinal bands of darker pigment on distal halves of these fins, an inner orange band situated at about two-thirds the length of the fin rays which is bordered throughout lengths of fins by distally positioned dark-black band.

**Pigmentation** (in alcohol, Fig. 1). General background coloration of ocular side dark brown with a series of prominent, darker-brown to black crossbands alternating with yellowish to cream-coloured crossbands. Ocular side of head with three dark-brown or black crossbands continuous across head; anteriormost crossing snout and chin; second crossband located immediately posterior to eyes; third crossband on body dorsally and crossing head on distal margin of opercle. Interorbital space and upper surfaces of eyes dark brown. Posterior one-third of anterior ocular-side nostril dark brown; basal two-thirds of nostril whitish. Body with 8–10, dark-brown or black, relatively straight, crossbands of nearly uniform width and usually continuous across body from base of dorsal fin to base of anal fin; occasionally crossbands in body mid-region interrupted in their mid-sections. Total number of crossbands (head and body combined) 11–13. Crossbands on body broader, sometimes as much as twice as wide, than proximate lighter-coloured crossbands. Both dark and lighter crossbands extending onto dorsal and anal fins in anterior one-half of body. Ocular side of body on some specimens with two, conspicuous, rounded, similar-sized white spots in longitudinal series on midline, one situated above posterior tips of elongated pectoral-fin rays between dark body crossbands 1–2 and the other on posterior one-third of body between dark crossbands 5–6. White spots nearly equal to, or slightly smaller than, eye diameter.

Isthmus and inner opercular lining on ocular side dark with numerous pepperdot melanophores; blind-side inner opercular linings and isthmus with pepper dots. Inner lining of mouth black. Blind side generally uniformly whitish to yellowish, with dense concentrations of pepperdot melanophores on body regions overlying pterygiophores of dorsal and anal fins. Pepper dots extending onto body scales in middle and posterior quarter of blind-side body in more darkly-pigmented specimens. Ocular sides of dorsal and anal fins darkly pigmented; each with continuous, uniformly black or dark-brown longitudinal band on distal one-half of fin rays throughout lengths of these fins, which widens on dorsal and anal fins in posterior one-half of body; basal halves of dorsal and anal fins usually lighter than distal halves; distalmost tips of dorsal- and anal-fin rays white. Blind sides of dorsal and anal fins uniformly black throughout their lengths. Ocular-side pectoral fin darkly pigmented; that on blind side whitish at base. Pelvic fins uniformly brown, except posteriormost part of blind-side fin with lighter pigment consisting of scattered melanophores. Ocular side of caudal fin with dark band on basal one-third of fin rays; with lighter band on middle one-third of fin; and with dark black band on distal one-third of fin forming continuous outline with black band on dorsal and anal fins; distalmost tips of caudal fin white. Blind side of caudal fin yellowish on its basal half, dark black on its distal half, and with fin-ray tips white.

**Distribution and habitat** (Fig. 2). Warm-temperate estuarine and neritic waters of New South Wales, Australia, from about 33°52'S to 30°27'S. Occurs on muddy bottoms in estuaries, harbours and in coastal waters at 3–20 m (Stead, 1908; Roughley, 1916; Kuiter, 1993). The few museum collections with accompanying depth data indicate that this species is taken from shallow waters to depths of at least 43 m.

**Remarks.** Chabanaud (1934) considered *Solea borbonica*, a species described on the basis of a single specimen, as part of a subdivision of a subspecies in his expanded taxon, *Aesopia japonica microcephala natio borbonica*. Quéro (1997) re-examined the holotype of *Solea borbonica* and concluded that *S. borbonica* was instead a valid species of *Soleichthys* that is endemic to Reunion Island, Indian Ocean. Fricke (1999), after comparing results of his study of the holotype of *Solea tubifera* Peters collected at Mauritius, concluded that *S. tubifera* and *S. borbonica* were conspecific, and therefore, *S. tubifera* was the appropriate name for this species. *Soleichthys tubiferus* (including *S. borbonicus*) differs most distinctively from *S. microcephalus* in its ocular-side coloration (uniformly greyish brown without crossbands) and more numerous (97 vs. 89 or less) lateral-line scales.

McCulloch (1921, 1922, 1927) tentatively suggested that *Solea lineata* Ramsay, 1883, described from a small, damaged specimen taken off Port Stephens, NSW, was a juvenile *S. microcephalus*, or more likely, based on its coloration (6 narrow crossbands on head, 25 crossbands on body) this nominal species was conspecific with (McCulloch, 1916, 1917), or a distinct species but one closely resembling *S. heterorhinos* (McCulloch, 1921, 1922, 1927). Whether *Solea lineata* and *S. heterorhinos* are conspecific needs further study. However, based on ocular-side colour patterns (numerous, narrow crossbands in *S. lineatus* vs. fewer, wider crossbands in adult *S. microcephalus* and uniformly pigmented ocular side without crossbands in juvenile *S.*

**Table 2.** Summary of selected morphometrics for syntype (BMNH 1855.9.19.1247) and 14 non-type specimens of *Soleichthys microcephalus*. Abbreviations defined in *Materials and methods* section; SL expressed in mm; other characters expressed in thousandths of SL; 13–17 in thousandths of HL; \* indicates only 13 specimens measured; SD, standard deviation.

character	syntype	non-type specimens		
		range	mean	SD
SL	166	113.4–172	151.5	18.02
PDL	36	19–38	26.1	4.63
BD	363	357–446	406.8	24.44
PL	—	78–122	98.4	10.10
CFL	125	126–145*	134.3	6.10
TKL	803	818–903	843.4	22.26
HL	167	160–181	172.1	6.37
HW	216	198–256	227.1	15.30
POL	78	89–119	101.1	8.79
SNL	28	29–47	39.6	5.00
UJL	54	28–44	37.1	3.98
ED	38	28–41	35.1	4.05
HW	1296	1112–1513	1323.1	113.19
POL	466	512–668	588.2	52.71
SNL	166	182–270	229.7	28.02
UJL	321	178–256	215.8	20.16
ED	227	169–237	203.6	20.72

*microcephalus*; see photo in Kuiter, 1993) and higher and non-overlapping meristic features for the holotype of *S. lineatus*: 95 dorsal-fin rays, 80 anal-fin rays, 109 lateral-line scales (scale count according to McCulloch, 1916), this nominal species is distinct from *S. microcephalus*.

**Comparisons.** *Soleichthys microcephalus* is readily differentiated from *S. heterorhinos*, *S. nigrostriolatus*, *S. lineatus* and *S. multifasciatus* by its lower meristic features (43–45 vs. 48–53 total vertebrae, 71–84 vs. 85–105 dorsal-fin rays, 61–71 vs. 74–91 anal-fin rays and 81–89 vs. 100–124 lateral-line scales in these other species, respectively) and in its pigmentation pattern including having only three crossbands (vs. 5 or more) on its head and in having fewer (8–10), wider crossbands on the body (vs. 17–31 crossbands in these others). It is distinguished from *S. serpenpellis* (see below) in body shape, and conspicuous differences in colour pattern, especially in having complete, and more numerous, crossbands on its ocular surface (compare Figs. 1 and 3). *Soleichthys microcephalus* is readily distinguished from *S. oculoasciatus* (see below) in having two equally elongated ocular-side pectoral-fin rays and by the presence of scales on these ocular-side pectoral-fin rays (vs. first pectoral-fin ray longer than second and scales absent on pectoral fin in *S. oculoasciatus*) and by its different body shape and ocular-side coloration (compare Figs. 1 and 4). *Soleichthys microcephalus* is readily distinguished from *S. siammakuti* and *S. maculosus* by its ocular-side colour pattern featuring bold, wide crossbands and in lacking conspicuous spots on the dorsal, anal and caudal fins (vs. crossbands not bold and wide or absent altogether, and spots present in these others). *Soleichthys microcephalus* differs conspicuously from *S. tubiferus* which has a uniformly pigmented ocular side (vs. prominent crossbands in *S. microcephalus*) and higher, non-overlapping counts of dorsal- and anal-fin rays, and lateral-line scales (see Remarks above).

### *Soleichthys serpenpellis* n.sp.

Figs. 2, 3; Tables 1, 3

Snakeskin sole

**Type Material.** HOLOTYPE, AMS IB.7211, 122.7 mm SL, Gulf of Carpentaria, 12–18°S 139–143°E. PARATYPES: AMS I.15557-066, 2(103.4–125.3 mm SL), Gulf of Carpentaria, 17°29'S 140°45'E, 4 m; QM I.11204, 117.8 mm SL, Gulf of Carpentaria, 16°35'55"S 140°48'20"E, 9 m; WAMP5739, 100.0 mm SL, Delambre Island, Dampier Archipelago off northwestern Australia, 21°S 117°E.

**Distinguishing characters.** *Soleichthys serpenpellis* is readily distinguished from all congeners by its combination of: low meristic features (44–46 vertebrae, 76–84 dorsal-fin rays, 64–71 anal-fin rays, and 83–95 lateral-line scales), a series of six incomplete, diamond-shaped crossbands on the ocular surface that are widest in their mid-sections and wider than respective interspaces between crossbands, with small, brown spots scattered in the interspaces between ocular-side crossbands, with three crossbands on the head, in having two white spots in longitudinal series along the midline of the ocular-side body, in its two elongated ocular-side pectoral-fin rays of nearly equal length or with the second fin ray longer than the first, and in having small scales present on bases and proximal halves of elongated ocular-side pectoral-fin rays.

**Description.** Meristic and morphometric features for the holotype and four paratypes are summarized in Tables 1 and 3. Body moderately elongate with nearly straight dorsal contour anteriorly, greatest depth (about 2.75 in SL) at a point in the anterior 33–50% of body length; taper gradual in posterior one-fifth of body; body thick, especially in region of pectoral fins. Head ca. 0.44 BD; wider than long (HW ca. 1.2–1.5 HL) with its ventral contour gently sloping posteriorly. Snout bluntly rounded, smaller than ED; snout tip on horizontal line through centre of fixed eye. Blind-side head with a few widely-spaced cirri also present along posterior margin of opercle. Ocular-side anterior nostril extending to about anterior margin of fixed eye when depressed posteriorly. Posterior margin of jaws at vertical through anterior margin of pupil of fixed eye. Lips fleshy, with longitudinal plicae. Eyes large (ED > SNL) and conspicuous, oval. Gill cover with fleshy membranous attachment to bases of three dorsalmost pectoral-fin rays on ocular side; on blind side, gill cover broadly connected by thick membrane to dorsalmost two or three pectoral-fin rays for nearly one-half their lengths. Ocular-side gill cover without obvious cirri; blind-side gill cover with cirri present along posterior border. Ocular-side lateral line anteriorly with small, curved portion posterior to migrated eye and extending dorsal to horizontal at dorsal margin of migrated eye. Dorsal-fin origin on body midline usually at vertical anterior to anterior margin of migrated eye. Dorsal-fin pterygiophore formula 1-1-2 (holotype and 3 paratypes) or 1-0-2 (1 paratype). Middle dorsal-fin rays slightly longer than those in other regions of fin. Both sides of dorsal-fin rays from a point anterior to mid-point of fin with a single row of ctenoid scales on their proximal halves; at approximately body mid-point to posterior end of dorsal fin, both sides of fin rays covered for nearly four-fifths their lengths with single row of small ctenoid scales. Proximal



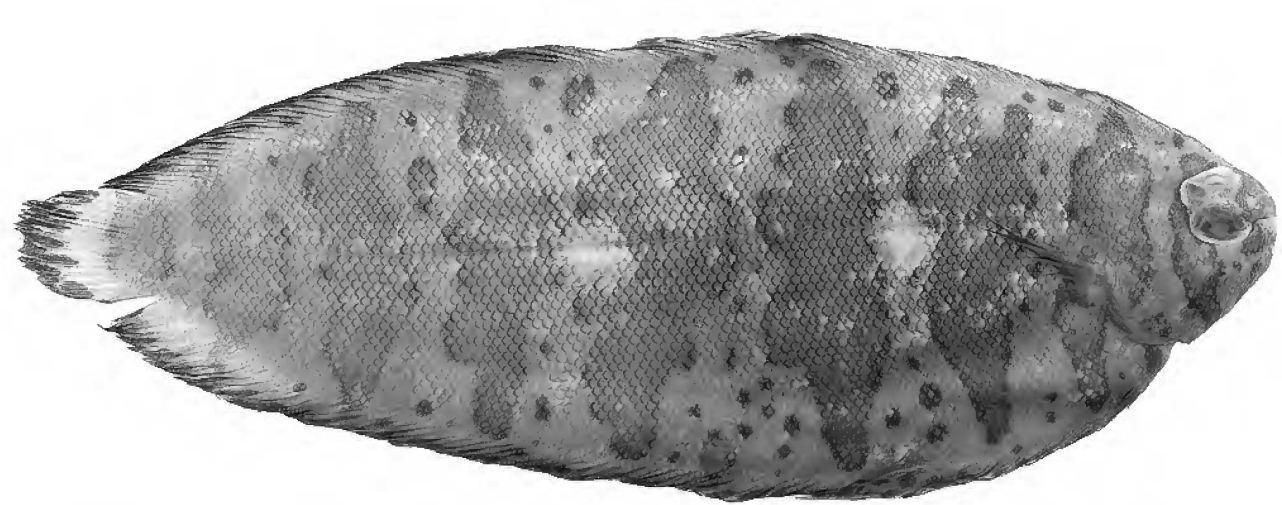


Fig. 3. *Soleichthys serpenpellis*, holotype, AMS IB.7211, 122.7 mm SL, Gulf of Carpentaria, Australia, 12–18°S 139–143°E.

halves of both sides of anal-fin rays in anterior one-fifth of fin covered with single row of ctenoid scales; scales gradually increasing in number (but not rows) posteriorly and eventually covering nearly proximal four-fifths of fin rays in posterior portions of anal fin. Caudal fin broadly rounded and relatively large, with 18–19 fin rays. Proximal three-fourths of ocular side of caudal fin scaly; scales covering only proximal half of blind side of caudal fin. Ocular-side pectoral fin long, pointed, with 8–9 fin rays, the two dorsalmost rays elongate with remainder decreasing in size progressively. Second ocular-side pectoral-fin ray slightly longer than first and nearly equal to head length; elongated pectoral-fin rays scaly for proximal one-third of their lengths; remainder of fin scaly only on basal region. Blind-side pectoral fin rounded, with 6–8 relatively short fin rays; two dorsalmost rays longer than remainder, which are nearly equal in size; pectoral-fin base about equal to length of longest blind-side fin ray; blind-side pectoral-fin rays not noticeably scaly, but with some scales on blind-side pectoral-fin base. Blind-side pelvic fin nearly on body midline; ocular-side pelvic fin with anteriormost ray on body midline and with remainder of fin rays dorsal to midline on right side. Scales on body small, strongly ctenoid, rhomboid, with ctenii in centre of scale more strongly developed than those on dorsal or ventral margins. Lateral-line scales small, rounded, cycloid, and with slightly raised pore.

**Pigmentation** (in alcohol, Fig. 3). Ocular-side background coloration generally light- to medium-brown with a series of 9–10 prominent darker crossbands from snout tip to base of caudal fin and with two conspicuous, rounded, white spots equal to, or slightly larger than, eye diameter in longitudinal series on body midline. Anterior spot situated between first and second crossband on body; posterior spot between crossbands 3 and 4. Body usually with 6–7, dark-brown, complete or nearly complete, crossbands covering body from base of dorsal fin to base of anal fin; crossbands in mid-body region of some specimens generally broader than others, with central regions wider than areas nearer bases of dorsal and anal fins. Body crossbands broader and more darkly pigmented than respective light-tan interspaces. Crossbands in anterior one-half of body nearly straight across vertical axis of body, whereas borders of posterior crossbands often with wavy appearance. Crossbands not

bordered by spots, but interspaces between crossbands on body and on head posteriorly with numerous, round dark-brown spots and irregular blotches. Head with three, dark-brown, continuous crossbands; the first on anterior snout and chin, second crossing region between middle and posterior margin of eyes and third crossband located posteriorly on head and gill cover. Ocular-side anterior nostril uniformly brown throughout its length. Mouth lining black. Inner opercular linings and isthmus on both sides with dense concentration of melanophores. Blind side uniformly yellowish-white, with scattering of pepperdot melanophores on scales along pterygiophore regions of dorsal and anal fins. Basal halves of ocular sides of dorsal and anal fins light tan similar to background coloration on body. Ocular sides of dorsal- and anal-fin rays with dense concentrations of melanophores throughout lengths of fin rays. Pigment intensifying on distal thirds or less of ocular sides of dorsal- and anal-fin rays, exclusive of tips, and

**Table 3.** Summary of selected morphometrics for the holotype (AMS IB.7211) and four paratypes of *Soleichthys serpenpellis*. Abbreviations defined in *Materials and methods* section; SL expressed in mm; other characters expressed in thousandths of SL; 13–17 in thousandths of HL; SD, standard deviation.

character	holotype	paratypes		
		range	mean	SD
SL	122.7	100.0–125.3	111.2	11.94
PDL	27	23–37	30.5	5.97
BD	373	350–382	362.2	14.24
PL	128	106–169	137.8	25.77
CFL	138	126–140	132.5	7.05
TKL	832	807–842	818.2	16.01
HL	165	153–177	167.2	11.09
HW	192	187–259	219.8	29.64
POL	79	85–103	91.0	8.16
SNL	38	32–47	39.5	7.59
UJL	32	35–47	40.8	6.65
ED	51	33–47	42.8	6.55
HW	1163	1056–1481	1318.5	186.12
POL	478	497–582	543.8	42.76
SNL	227	207–262	234.2	30.90
UJL	192	212–271	243.0	27.26
ED	310	186–292	257.8	48.47

forming continuous or nearly continuous longitudinal dark-brown to blackish band throughout entire lengths of fins. Longitudinal band solid in some regions and in others comprised of two parallel rows of irregular spots covering several fin rays and joining membrane; spots frequently coalesce into larger, darkly pigmented blotches in some areas of these fins. Distal band darkest on posterior one-third of dorsal and anal fins. Distal tips of dorsal- and anal-fin rays in anterior region of fin whitish. Blind sides of dorsal and anal fins with melanophores throughout length of fin rays and with dark, blackish-brown band on distal two-thirds of fins in anterior two-thirds of body, and with band on distal one-third of fins in posterior region of body. Ocular side of caudal fin with medium-brown band on proximal one-third of fin rays; middle one-third of caudal fin tan-coloured with lighter concentration of melanophores; and distal one-third of fin with dark (blackish) band continuous with that of dorsal and anal fins. Blind side of caudal fin white basally, with dark melanophores on middle third, and with more solid blackish-brown pigment on distal one-third of fin. Ocular-side pectoral fin with uniformly brown pigment throughout length of fin rays, with distal tips of elongated fin rays white, and with darker, nearly black, pigment streaks on membrane between elongated fin rays; blind-side pectoral fin with pepperdot melanophores on fin and sometimes also with pepper dots on body scales immediately behind blind-side pectoral fin. Pelvic fins blackish-brown with membrane more darkly pigmented than most fin rays.

**Distribution and habitat** (Fig. 2). Tropical waters of northern Australia; four specimens were taken in the Gulf of Carpentaria, Queensland (18°S–16°35'S), and a single specimen was captured east of Delambre Island, Dampier Archipelago, northwestern Australia (21°S 117°E). The available specimens were captured in depths of 4–9 m.

**Etymology.** From the Latin, *serpen*, snake, and *pellis*, skin; in reference to the distinctive ocular-side pigmentation pattern in this species that is reminiscent of a snake-skin colour pattern.

**Comparisons.** *Soleichthys serpenpellis* is readily differentiated from *S. heterorhinos*, *S. nigrostriolatus*, *S. multifasciatus* and *S. lineatus* by its lower meristic features (44–45 vs. 48–53 total vertebrae, 76–84 vs. 85–105 dorsal-fin rays, 64–71 vs. 74–91 anal-fin rays and 83–95 vs. 100–124 lateral-line scales in these other species, respectively) and in its pigmentation pattern including fewer (6–7), wider crossbands on its body (vs. 17–31 crossbands in these others). It differs from *S. heterorhinos*, *S. nigrostriolatus*, and *S. multifasciatus* in having only three crossbands on its head (vs. usually five or more in these others). *Soleichthys serpenpellis* differs from *S. microcephalus* and *S. oculofasciatus* (see below) in having incomplete, diamond-shaped crossbands on the body (vs. complete bands of different shape in these other species), in having fewer total ocular-side crossbands than these others, and in having numerous brown spots distributed among ocular-side crossbands (vs. brown spots lacking in these others). *Soleichthys serpenpellis* is further distinguished from *S. oculofasciatus* in having only two, conspicuous white spots situated mid-laterally in a horizontal series on the ocular side (vs. four white spots with two arranged in vertical series), in having the second elongated pectoral-fin ray as long as or longer than the first (vs. second elongated

pectoral-fin ray shorter than first), and in having scales on elongated rays of the ocular-side pectoral fin (vs. scales lacking on elongated pectoral-fin rays). *Soleichthys serpenpellis* also differs from *S. oculofasciatus* in having a shorter and wider head and a shorter caudal fin (compare respective data in Tables 3 and 4). *Soleichthys serpenpellis* differs from *S. siammakuti* and *S. maculosus* in lacking spots on the fins characteristic of these other species. *Soleichthys tubiferus* is most easily distinguished from the new species by its uniformly pigmented ocular side (vs. prominent crossbands in *S. serpenpellis*).

### *Soleichthys oculofasciatus* n.sp.

Figs. 2, 4; Tables 1, 4

Banded-eye Sole

**Type material.** HOLOTYPE: QM I.23589, 107.7 mm SL, Trunk Reef, Australia, 18°23.5'S 146°45'E, 49 m. PARATYPE: QM I.23194, 124.6 mm SL, N. Cape Bowling Green, 19°9'S 147°24'E, 28 m.

**Distinguishing characters.** *Soleichthys oculofasciatus* is readily distinguished from congeners in having a combination of: low meristic features (45–46 vertebrae, 79–81 dorsal-fin rays, 68 anal-fin rays, and 85–86 lateral-line scales), a series of 11 complete crossbands on the ocular side that are wider than their respective interspaces, four conspicuous white spots on its ocular surface with two arranged in vertical series, three crossbands on the head, two elongate ocular-side pectoral-fin rays with the first fin ray noticeably longer than the second, and in lacking scales on the ocular-side pectoral-fin base and proximal halves of elongated ocular-side pectoral-fin rays.

**Description.** Meristic and morphometric features for the holotype and paratype are summarized in Tables 1 and 4. Body elongate, greatest depth (about 2.5 in SL) in anterior one-third of body; taper gradual in posterior one-fifth of body; body thick, especially in region of pectoral fins. Head ca. 0.52 BD; narrow; head width equal to, or slightly larger than, head length; dorsal and ventral contours of head gently sloped posteriorly. Snout bluntly squarish; about equal to or slightly larger than eye diameter; snout tip on horizontal through ventral region of fixed eye. Ocular-side snout without dermal papillae or conspicuous cirri; blind-side snout with well-developed papillae and cirri in nostril region and along dorsal profile overlying pterygiophore region. Ocular-side anterior nostril when depressed posteriorly usually extending to point between anterior margin and middle of fixed eye. Posterior margin of jaws at point between verticals through anterior margin of pupil and anterior margin of fixed eye. Ocular-side upper lip smooth, lower lip with longitudinal plicae. Blind-side lips with several obvious plicae. Eyes large (ED > SNL), conspicuous, oval. Opercles without obvious cirri. Gill covers with fleshy membranous attachment to dorsalmost pectoral-fin rays in each fin; on the ocular-side, opercular membrane extends from bases to about half-way point of two longest fin rays; blind-side opercular membrane thicker and connected to dorsalmost two or three pectoral-fin rays from their bases nearly to their distal tips. Ocular-side lateral line anteriorly with noticeably curved portion on opercle and continuing anteriorly onto head and terminating at point dorsal to, and



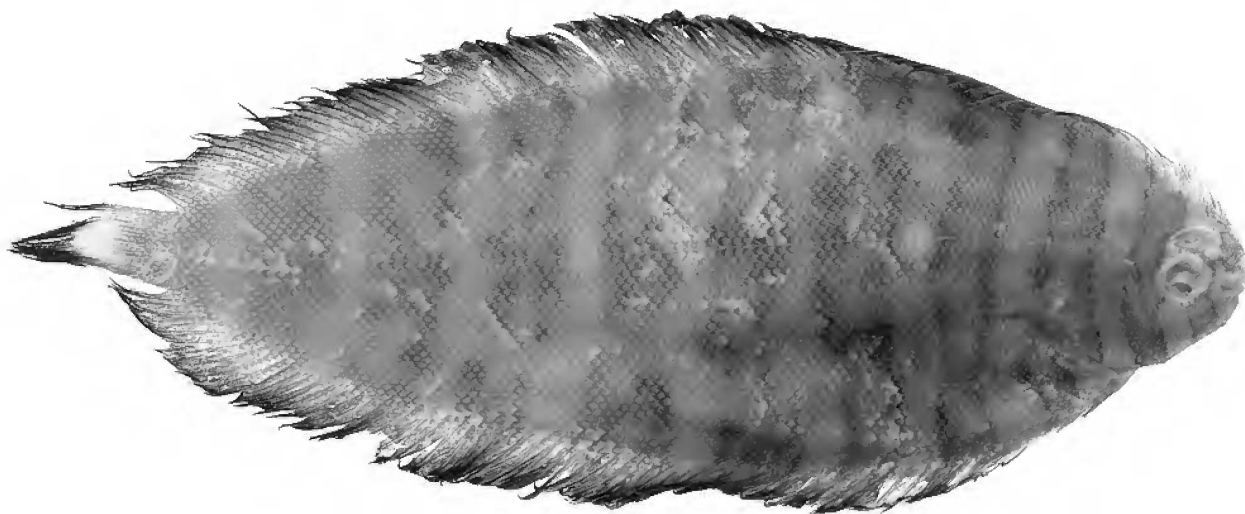


Fig. 4. *Soleichthys oculo-fasciatus*, holotype, QM I.23589, 107.7 mm SL, Trunk Reef, Australia, 18°23.5'S 146°45'E.

posterior of, migrated eye. Dorsal-fin origin on midline, usually at vertical between mid-point of upper jaw and anterior margin of migrated eye. Dorsal-fin pterygiophore formula 1-2-2 (holotype) or 2-0-2 (paratype). Dorsal-fin rays nearly equal in length throughout fin. Basal one-third of ocular sides of dorsal-fin rays in anterior region of fin covered with small ctenoid scales; in posterior two-thirds of fin, fin rays with scales covering about three-fourths of their lengths. Anal-fin rays about equal in length throughout fin. Ocular sides of anal-fin rays mostly without scales, except that anterior anal-fin rays with small ctenoid scales on their basal regions. Blind sides of dorsal- and anal-fin rays without scales in anterior two-thirds of fin and with scales covering basal portion to about one-third length of fin rays in posterior thirds of these fins. Caudal fin

**Table 4.** Summary of selected morphometrics for the holotype (QM I.23589) and paratype (QM I.23194) of *Soleichthys oculo-fasciatus*. Abbreviations defined in *Materials and methods* section; SL expressed in mm; other characters expressed in thousandths of SL; 13–17 in thousandths of HL; SD, standard deviation.

	character	holotype	paratype
1	SL	107.7	124.6
2	PDL	22	24
3	BD	362	363
4	PL	102	—
5	CFL	168	149
6	TKL	819	831
7	HL	191	185
8	HW	191	193
9	POL	108	104
10	SNL	40	37
11	UJL	44	43
12	ED	37	38
13	HW	1000	1043
14	POL	563	565
15	SNL	209	200
16	UJL	228	235
17	ED	194	204

rectangular, long, with nearly all fin rays of equal length; with 18 fin rays. Proximal one-half of ocular side of caudal fin covered with ctenoid scales; blind side of caudal fin with scales covering basal one-third of fin and also extending to about mid-point of some caudal-fin rays. Ocular-side pectoral fin long, pointed, with 11 rays; two dorsalmost rays elongated, with consecutive fin rays becoming progressively shorter. First ocular-side pectoral-fin ray noticeably longer than second (length of longest fin ray nearly equal to POL); elongated pectoral-fin rays without scales; remainder of fin scaly only on its basal region. Blind-side pectoral fin short, rounded, with 10–11 relatively short fin rays; blind-side pectoral-fin rays and fin base not noticeably scaly. Blind-side pelvic fin nearly on body midline, ocular-side pelvic fin situated slightly on right side of body. Scales on body small, somewhat pointed in centres, strongly ctenoid with ctenii best developed in central region of scales. Lateral-line scales small, cycloid, with small, slightly raised pore.

**Pigmentation** (in alcohol, Fig. 4). Ocular-side background colouration medium- to dark-brown with a series of 11 continuous, mostly straight, darker-brown crossbands on head and body and with at least four conspicuous, rounded white spots on body. Head with three continuous crossbands, anteriormost crossing snout and chin, middle band passing immediately posterior to eyes, and posteriormost band on posterior head and opercle. Eight crossbands of nearly uniform width throughout their lengths extending continuously across body from dorsal-fin base to anal-fin base beginning from area posterior to pectoral-fin insertion and continuing posteriorly to caudal-fin base. Anterior and posterior borders of body crossbands, especially in their dorsal and ventral regions, generally outlined with darker pigment than their mid-lateral regions. Crossbands on posterior head and body generally broader than respective interspaces, which are light tan to whitish. Pigmentation of both crossbands and interspaces continued onto proximal two-thirds of dorsal- and anal-fin rays. Body also with four, small, rounded white spots; the most conspicuous spot (approximately equals ED) situated on lateral line just beyond distal tips of elongated pectoral-fin rays; second largest spot (slightly smaller than ED) on dorsal margin at mid-body region; ventralmost spot on ventral body margin at base of anal-fin



rays on vertical equal with dorsalmost spot; smallest spot (smaller than pupil of eye) less conspicuous than others and located on dorsal margin of body between gill opening and tip of elongated pectoral-fin rays. Ocular-side anterior nostril uniformly brown throughout its length. Inner lining of mouth black. Inner linings of opercles and ocular-side isthmus with concentrations of pepperdot melanophores. Blind side of head and body yellowish-white. Holotype without pepperdot melanophores on blind side; paratype with small number of pepperdots on blind side along pterygiophore regions of dorsal and anal fins. Crossbands of body continued onto proximal two-thirds of dorsal and anal fins. Anteriormost dorsal-fin rays whitish on both sides. Otherwise, ocular sides of dorsal and anal fins with light-brown basal membranes and with fin rays streaked noticeably darker (and more outlined) than membranes; distal one-third of dorsal- and anal-fin rays with longitudinal dark band continuous or nearly continuous throughout entire length of fins. Blind sides of dorsal and anal fins dark-brown throughout entire lengths of fin rays and with black band on distal one-half to one-third of fin rays. Proximal one-third of ocular side of caudal fin with brown crossband basally; middle third of fin whitish; and with a black pigment band on distal one-third of caudal fin continuous with that on dorsal and anal fins. Proximal three-fourths of blind side of caudal fin off-white to yellowish; distal one-third of caudal fin on blind side with black band. Ocular-side pectoral fin uniformly dark brown, darker than crossbands on body; blind-side pectoral fin white, with very few pepperdot melanophores on fin and fin base, and without pepperdots on body region behind pectoral fin. Ocular-side pelvic fin dark brown; blind-side pelvic fin whitish.

**Distribution** (Fig. 2). Known from two specimens collected in tropical waters off eastern Queensland; one taken in 49 m at Trunk Reef, eastern Australia (18°23'S) and the other collected at 28 m at a site north of Cape Bowling Green (19°9'S).

**Etymology.** From the Latin, *oculatus*, having eyes, and *fasciatus* meaning banded; in reference to the pigment band encompassing the eyes of this species.

**Comparisons.** *Soleichthys oculofasciatus* is readily differentiated from *S. heterorhinos*, *S. nigrostriolatus*, *S. lineatus* and *S. multifasciatus* by its lower meristic features (45–46 vs. 48–53 total vertebrae, 79–81 vs. 85–105 dorsal-fin rays, 68 vs. 74–91 anal-fin rays and 85–86 vs. 100–124 lateral-line scales in these other species, respectively) and in its pigmentation pattern including fewer (8 vs. 17–31) body crossbands. It further differs from *S. heterorhinos*, *S. nigrostriolatus* and *S. multifasciatus* in having only three crossbands on its head (vs. more than five crossbands in these other species). *Soleichthys oculofasciatus* differs from *S. microcephalus* and *S. serpenpellis* in having the first elongate ocular-side pectoral-fin ray longer than the second (vs. second elongate pectoral-fin ray longer than first) and in lacking scales on the elongate pectoral-fin ray (vs. scales present). The new species differs further from both *S. microcephalus* and *S. serpenpellis* in having a longer and narrower head and longer caudal fin (compare respective data in Tables 2, 3 and 4). It is further differentiated from *S. serpenpellis* in having complete crossbands (vs. some incomplete), in having four white spots of different sizes, two of which are in vertical alignment, on its ocular surface

(vs. two spots of nearly equal size and in horizontal alignment) and in lacking small, brown spots on its ocular side (vs. spots present). From *S. siammakuti* and *S. maculosus*, *S. oculofasciatus* is readily distinguished in lacking spots on the dorsal, anal, and caudal fins characteristic of these other species. *Soleichthys oculofasciatus* can also be distinguished from *S. tubiferus* because the latter species lacks crossbands in its ocular-side colour pattern.

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## References

- Bleeker, P.E., 1856. Beschrijvingen van nieuwe en weinig bekende vischsoorten van Amboina, verzameld op eene reis door den Molukschen Archipel gedaan in het gevolg van den Gouverneur Generaal Duymaer van Twist in September en October 1855. *Acta Societatis Scientiarum Indo-Neerlandicae* 1: 1–76.
- Bleeker, P.E., 1860. Enumeratio specierum piscium hucusque in Archipelago Indico. Observatarum, adjectis habitationibus citationibusque, ubi descriptiones earum recentiores reperiuntur, nec non speciebus Musei Bleekeriani Bengalensibus, Japonicis, Capensibus, Tasmanicisque. *Acta Societatis Scientiarum Indo-Neerlandicae* 6: 1–276.
- Chabanaud, P., 1930. Les genres de poissons Hétérosomates (Pisces Heterosomata) appartenant à la sous-famille des Soleinae. *Bulletin de l'Institut Océanographique, Monaco* 555: 1–22.
- Chabanaud, P., 1934. Les Soléidés du groupe *Zebrias*. Définition d'un sous-genre nouveau et description d'une sous-espèce nouvelle. *Bulletin de la Société Zoologique de France* 59: 420–436.
- Chapleau, F., 1989. Étude de la portion supracrânienne de la nageoire dorsale chez les Soleidae (Téléostéens, Pleuronectiformes). *Cybium* 13: 271–279.
- Desoutter, M., & F. Chapleau, 1997. Taxonomic status of *Bathysolea profundicola* and *B. polli* (Soleidae; Pleuronectiformes) with notes on the genus. *Ichthyological Research* 44(4): 399–412.
- Eschmeyer, W.N., 1998. Collection abbreviations. In *Catalog of Fishes* ed. W.N. Eschmeyer, pp. 16–22. Special Publication 1, Center for Biodiversity Research Information, California Academy of Sciences, San Francisco.
- Fricke, R., 1999. *Fishes of the Mascarene Islands (Réunion, Mauritius, Rodriguez). An Annotated Checklist, With Descriptions of New Species*. Theses Zoologicae. Vol. 31. Koenigstein Koeltz Scientific Books, Koenigstein, pp. 759.
- Günther, A., 1862. *Catalogue of the Fishes in the British Museum*. Volume 4. London: British Museum, pp. 534.

- Günther, A., 1909. Andrew Garrett's Fische der Südsee. Band III, Heft VIII. Journal des Museum Godeffroy, Band VI, Heft XVI. J. Friederichsen & Co., Hamburg. 261–388.
- Kaup, J.J., 1858. Uebersicht der Soleinae, der vierten Subfamilie der Pleuronectidae. *Archiv für Naturgeschichte* 24(1): 94–104.
- Kner, R., 1867. Fische. Reise der österreichischen Fregatte "Novara" um die Erde in den Jahren 1857–1859, unter den Befehlen des Commodore B. von Wüllerstorff-Urbair. Zoologischer Theil. (Erster Band) Fische. *Wien Zoologischer Theil* 1(3): 275–433.
- Kuiter, R.H., 1993. *Coastal Fishes of South-East Australia*. Bathurst: Crawford House Press, pp. 437.
- Macleay, W., 1882. Descriptive catalogue of the fishes of Australia. Part III. *Proceedings of the Linnaean Society of New South Wales* 6: 1–138.
- McCulloch, A.R., 1916. Ichthyological items. *Memoirs of the Queensland Museum* 5: 59–69.
- McCulloch, A.R., 1917. Ichthyological notes. *Australian Zoologist* 6: 89–93.
- McCulloch, A.R., 1921. Check-list of the fish and fish-like animals of New South Wales. Part II. *The Australian Zoologist* 2: 24–68.
- McCulloch, A.R., 1922. Check list of the fish and fish-like animals of New South Wales. Part III. *The Australian Zoologist* 2: 86–130.
- McCulloch, A.R., 1927. The fishes and fish-like animals of New South Wales. *Royal Zoological Society of New South Wales*, pp. 104.
- McCulloch, A.R., 1929–1930. A check list of the fishes recorded from Australia. Parts I–IV. *Memoir of the Australian Museum* 5: 1–534.
- Muchhala, N., & T.A. Munroe, 2004. A new species of *Soleichthys* (Soleidae: Pleuronectiformes) from tropical seas of northern Australia. *Ichthyological Research* 51: 57–62.
- Munro, I.S.R., 1938. Handbook of Australian fishes. *Fishery Newsletter* 16(11): 1–172.
- Norman, J.R., 1926. A report on the flatfishes (Heterosomata) collected by the F.I.S. "Endeavour", with a synopsis of the flatfishes of Australia and a revision of the subfamily Rhombosoleinae. *Biological results of the fishing experiments carried on by the "Endeavour", 1909–14*. 5(part 5): 219–308.
- Norman, J.R., 1928. The flatfishes (Heterosomata) of India, with a list of the specimens in the Indian Museum. Part II. *Records of the Indian Museum* 30: 173–215.
- Ogilby, J.D., 1886. *Catalogue of the Fishes of New South Wales, with Their Principal Synonyms*. Sydney: Thomas Richards, Government Printer, pp. 67.
- Peters, W.C.H., 1876. Übersicht der von Hrn. Prof. Dr. K. Möbius in Mauritius und bei den Seychellen gesammelten Fische. *Monatsberichte der Königl. Akademie der Wissenschaften zu Berlin* 1875: 435–447.
- Quéro, J.-C., 1997. Soleidae et Cynoglossidae (Pleuronectiformes) de l'Île la Réunion (Océan Indien): description d'une nouvelle espèce. *Cybium* 21(3): 319–329.
- Ramsay, E.P., 1883. Description of some new Australian fishes. *Proceedings of the Linnaean Society of New South Wales* 8: 177–179.
- Regan, C.T., 1905. Description de six poissons nouveau faisant partie de la collection du Musée d'Histoire naturelle de Genève. *Revue Suisse de Zoologie* 13: 389–393.
- Roughley, T.C., 1916. *Fishes of Australia and Their Technology*. Sydney: William Applegate Gullick, Government Printer, pp. 296.
- Stead, D.G., 1908. *The Edible Fishes of New South Wales, Their Present Importance and Their Potentialities*. Sydney: Government of the State of New South Wales, pp. 119.
- Steindachner, F., & R. Kner, 1870. Über einige Pleuronectiden, Salmoniden, Gadoiden und Blenniiden aus der Decastris-Bay und von Viti-Levu. *Akademie der Wissenschaften Sitzungsberichte* 61(1): 421–446.
- Waite, E.R., 1904. A synopsis of the fishes of New South Wales. *Memoirs of the New South Wales Naturalists' Club*, no. 2, pp. 54.
- Weber, M., & L.F. de Beaufort, 1929. *The Fishes of the Indo-Australian Archipelago*. V. Anacanthini, Allotriognathi, Heterosomata, Berycomorphi, Percomorphi: Families Kuhlidae, Apogonidae, Plesiopidae, Pseudoplesiopidae, Priacanthidae, Centropomidae. Leiden: E.J. Brill Limited, pp. 458.
- Wongratana, T., 1975. *Soleichthys stammakuti* n. sp., a rare sole from the Gulf of Thailand (Pisces: Soleidae). *Senckenbergiana Biologia* 56: 21–29.
- Yearsley, G.K., P.R. Last & G.B. Morris, 1997. Codes for Australian aquatic biota (CAAB): an upgraded and expanded species coding system for Australian fisheries databases. CSIRO Marine Laboratories. Report 224, pp. 15, and Appendices.

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